using a Windkessel model based on the output blood flow. Images **2420** and **2430** show pressure-volume loops for the LV and RV, respectively, each of which illustrates the four different cardiac phases.

[0103] FIG. **25** illustrates a sequence of frames illustrating the second simulated heart beat in the patient. The shading in FIG. **25** represents the active contraction in the heart tissue. As can be seen in FIG. **25**, the simulation has been able to reproduce the cardiac function in that patient, in particular ejection fraction and ventricular volume changes. For this first experiment, atrial pressure is constant.

[0104] The above-described methods for generating a patient-specific anatomic model of the heart, generating a patient-specific computational model of the heart, and performing patient-specific CRT simulations can be implemented on a computer using well-known computer processors, memory units, storage devices, computer software, and other components. A high-level block diagram of such a computer is illustrated in FIG. **26**. Computer **2602** contains a processor **2604**, which controls the overall operation of the computer **2602** by executing computer program instructions which define such operation. The computer program instructions may be stored in a storage device **2612** (e.g., magnetic disk) and loaded into memory **2610** when execution of the computer program instructions is desired. Thus, the steps of the methods of FIGS. **1**, **2**, **3**, **4**, **16** and **17** may be defined by the computer program instructions stored in the memory **2610** and/or storage **2612** and controlled by the processor **2604** executing the computer program instructions. An image acquisition device **2620**, such as an MR scanning device, Ultrasound device, etc., can be connected to the computer **2602** to input image data to the computer **2602**. It is possible to implement the image acquisition device **2620** and the computer **2602** as one device. It is also possible that the image acquisition device **2620** and the computer **2602** communicate wirelessly through a network. The computer **2602** also includes one or more network interfaces **2606** for communicating with other devices via a network. The computer **2602** also includes other input/output devices **2608** that enable user interaction with the computer **2602** (e.g., display, keyboard, mouse, speakers, buttons, etc.). Such input/output devices **2608** may be used in conjunction with a set of computer programs as an annotation tool to annotate volumes received from the image acquisition device **2620**. One skilled in the art will recognize that an implementation of an actual computer could contain other components as well, and that FIG. **26** is a high level representation of some of the components of such a computer for illustrative purposes.

[0105] The foregoing Detailed Description is to be understood as being in every respect illustrative and exemplary, but not restrictive, and the scope of the invention disclosed herein is not to be determined from the Detailed Description, but rather from the claims as interpreted according to the full breadth permitted by the patent laws. It is to be understood that the embodiments shown and described herein are only illustrative of the principles of the present invention and that various modifications may be implemented by those skilled in the art without departing from the scope and spirit of the invention. Those skilled in the art could implement various other feature combinations without departing from the scope and spirit of the invention.

1. A method for patient-specific cardiac therapy planning, comprising:

generating a patient-specific anatomical model of left and right ventricles from medical image data of a patient;

generating a patient-specific computational heart model based on the patient-specific anatomical model of the left and right ventricles and patient-specific clinical data; and

simulating a cardiac therapy using the patient-specific computational heart model.

2. The method of claim **1**, wherein the step of generating a patient-specific anatomical model of left and right ventricles from medical image data of a patient comprises:

detecting a patient-specific left ventricle model and a patient-specific right ventricle model in the medical image data; and

fusing the left ventricle model and the right ventricle model into a single bi-ventricular volumetric mesh.

3. The method of claim **2**, wherein the step of generating a patient-specific anatomical model of left and right ventricles from medical image data of a patient further comprises:

mapping spatial information corresponding to at least one of scars, grey zones, or fibrosis onto a tetrahedral representation of bi-ventricular volumetric mesh.

4. The method of claim **2**, wherein the step of generating a patient-specific anatomical model of left and right ventricles from medical image data of a patient further comprises:

generating a model of fiber orientation based on the bi-ventricular volumetric mesh.

5. The method of claim **4**, wherein the step of generating a model of fiber orientation based on the bi-ventricular volumetric mesh comprises:

determining a constant orientation for fibers on the epicardium and endocardium between a base plane and an apex of the heart;

determining fibers around the mitral, tricuspid, and pulmonary valves to have a circumferential orientation and fibers around the left ventricle outflow tract to have a longitudinal orientation;

performing geodesic interpolation of fiber orientations for fibers on the endocardium and epicardium between the base plane and the valves; and

calculating orientations of fibers across the myocardium using linear interpolation.

6. The method of claim **1**, wherein the step of generating a patient-specific computational heart model based on the patient-specific anatomical model of the left and right ventricles and patient-specific clinical data comprises:

determining patient-specific parameters of the computational heart model based on the patient-specific anatomical model of the left and right ventricles and the patient-specific clinical data.

7. The method of claim **6**, wherein the step of determining patient-specific parameters of the computational heart model based on the patient-specific anatomical model of the left and right ventricles and the patient-specific clinical data comprises:

simulating heart function using the computational heart model; and

adjusting the parameters of the computational heart model to control simulated clinical parameters resulting from the simulation of heart function using the computational heart model to match corresponding measured clinical parameters for the patient.